

- Rees, W. J. 1951. The giant African snail. *Proc. Zool. Soc. London*, 120 (3) : 577-598.
- Thirwell, M. D., Strasdine, G. A. & Whitaker, D. R. 1963. A comparison of hydrolase and lytic activities of the digestive juices of the giant African snail *Achatina fulica* and *Helix pomotia*. *Canadian Journ. Biochem. and Physics*, 41: 1603-1610.
- Williams, F. X. 1951. Life-history studies of east African *Achatina* snails. *Bull. Mus. Comp. Zool., Harvard*, 105 (3) : 295-317.

THREE NEW SONORELLA FROM SOUTHWEST ARIZONA

By WALTER B. MILLER

Department of Zoology, University of Arizona

In early 1918, James H. Ferriss explored for mollusks in the area west of Tucson, Arizona, as far as Ajo. He stated that the large Growler Range west of Ajo city looked promising from a distance, but the Mexican bandits were active at that time along the western boundary. This was apparently sufficient deterrence, even for an ardent collector like Ferriss. The most western locality for *Sonorella* on that trip turned out to be "3 miles west of Comovo Church" (now Kom Vo) in the Papago Indian Reservation.

In recent years, explorations for mollusks have been resumed in this general area. Snails have been brought to the University of Arizona from the Organ Pipe National Monument, the Cabeza Prieta Game Range, and the Picacho Mts. They are described below.

SONORELLA BABOQUIVARIENSIS COSSI new subspecies. Plate I, figs. A-C.

Description: Shell depressed-globose, heliciform, thin, glossy, light brown, with a chestnut-brown spiral band on the well rounded shoulder; narrowly and half-covered umbilicate, the umbilicus contained about 13 times in the diameter. Embryonic shell of about $1\frac{1}{4}$ whorls, with apical sculpture like *S. hachitana*. First half whorl irregularly radially wrinkled only, the remainder of the embryonic shell with forwardly descending spiral threads superimposed on the radial sculpture. First $2\frac{1}{2}$ whorls, including embryonic whorls, show scars of worn off, hair-like periostracal projections. Remaining whorls with faint, raised growth striae, with a silky luster. Body whorl descending only slightly to the narrowly expanded peristome. The columellar margin of the peristome is broadly expanded and reflexed to cover nearly half of the umbilicus. Aperture oblique, large, broadly ovate, its width more than

half the diameter of the shell; with a thin parietal callus.

Holotype measurements: Height 11.7 mm.; max. diam. 19.2 mm.; umbilicus 1.5 mm.; whorls $4\frac{1}{2}$.

Genitalia of holotype (Plate 2, fig. A): The penis contains a relatively small cylindric verge with a blunt, rounded end. The epiphallus is only slightly longer than the penis and bears a long (for the genus), well detached, epiphallic caecum. The penial retractor inserts on the epiphallus a short distance above the penis. Penial sheath relatively long, about half the length of the penis. The vagina is about as long as the penis and about twice as long as the free oviduct.

Measurements of
genitalia, in mm.

| | Holotype | Paratype A | Paratype C |
|-------------------|----------|------------|------------|
| Penis | 8.0 | 7.0 | 6.0 |
| Verge | 2.5 | 2.5 | 2.5 |
| Penial sheath | 3.5 | 4.5 | 4.5 |
| Epiphallus | 9.0 | 8.0 | 8.5 |
| Epiphallic caecum | 1.0 | 1.0 | 1.5 |
| Vagina | 8.0 | 9.0 | 7.5 |
| Free oviduct | 4.0 | 4.0 | 4.0 |

Type locality: Ajo Range, Organ Pipe Cactus National Monument, Pima Co., Arizona, in rockslide along left bank of Arch canyon, at base of north facing cliffs about $\frac{1}{2}$ mile upstream from the Arch; elevation ca. 2900 ft. (J. Bequaert and W. B. Miller, 25 Jan. 1965). Holotype ANSP. (308955). Paratypes in collections of ANSP. (308956), Dept. of Zoology, University of Arizona (879), and the author (4745).

Other localities: Upper Arch canyon, Ajo Range, elev. ca. 3500 ft. to 4000 ft. (Harold T. Coss, 12 April 1965). Cave in saddle about $\frac{1}{4}$ mile south of the Arch in Arch canyon (Harold T. Coss and Jim Taylor, 6 Feb. 1966).

In shell characteristics, this subspecies is not distinguishable from small forms of *S. baboquivariensis* s.s. The smallest paratype measures: height 11.2 mm.; max. diam. 17.2 mm.; umbilicus 1.3 mm.; whorls $4\frac{1}{2}$. The largest paratype measures: height 12.3 mm.; max. diam. 19.5 mm.; umbilicus 1.6 mm.; whorls $4\frac{1}{2}$. Specimens of *cosi* from upper Arch canyon ran even smaller, with max. diam. as low as 15.0 mm. In embryonic sculpture, *cosi* displays the protractive spiral threads consistently in all specimens examined, where the apical sculpture was not completely worn off. Some fresh young shells also show ascending spiral threads on the embryonic whorls.

In the genitalia, *cozzi* differs significantly and consistently from *baboquivariensis* s.s. The verge is smaller, ca. $\frac{1}{3}$ the length of the penis, and does not have a swollen, glandiform tip. The vagina is as long as or longer than the penis, and the epiphallic caecum is particularly long and detached (for the genus).

Since the shell characteristics are so similar to those of *baboquivariensis* s.s., only a subspecific distinction seems indicated. Hybridization experiments between the nominate species and *cozzi* are planned; if they reveal evidence that potential interbreeding between them no longer exists, this subspecies would have to be raised to specific rank.

The subspecies is named after Mr. Harold T. Coss of the National Park Service who was stationed at the Organ Pipe National Monument in 1965 and brought in the first specimens of this snail to the University of Arizona. For some time, this was the westernmost known population of *Sonorella* in southwestern Arizona, until further explorations revealed other populations farther west (*vide infra*).

SONORELLA SIMMONSI new species.

Plate 1, figs D-F.

Description: Shell depressed, heliciform, thin to solid, glossy, light brown, with chestnut brown spiral band on the well rounded shoulder; umbilicate, the umbilicus contained 8 to 9 times in the diameter. Embryonic shell of about 1 and $\frac{1}{3}$ whorls, with sculpture like *S. hachitana*; its apex smooth; the remainder with weak, irregular radial wrinkles and fine, spirally arranged, hyphen-like papillae which anastomose over the last third of the embryonic shell into thin, forwardly descending threads. Later whorls have light growth lines with occasional papillae at first, the papillae disappearing on the body whorl. Body whorl smooth, with a silky luster. Aperture oblique, rounded, slightly wider than high. Peristome expanded, the margins converging; parietal callus thin.

Holotype measurements: Height 12.0 mm.; max. diam. 20.6 mm.; umbilicus 2.6 mm.; whorls 5.

Genitalia of holotype (Plate 2, fig. C): Penis large and thick, equally thick throughout. A short, thick penial sheath envelops its base. The verge is nearly as long as the penis, moderately thick, its largest diameter at about $\frac{1}{3}$ of its length from the epiphallus, then slowly tapering toward the abruptly truncate tip, indistinctly annulate. The slender epiphallus is as long as the penis and bears

the retractor muscle near its distal end; near its proximal end, it is invested by connective tissue from the upper end of the penial sheath. Epiphallic caecum small, only slightly detached from the epiphallus. Vagina $\frac{2}{3}$ to $\frac{3}{4}$ the length of the penis, about 3 times as long as the free oviduct.

Measurements of
genitalia, in mm.

| | Holotype | Paratype A | Paratype B |
|-------------------|----------|------------|------------|
| Penis | 15.0 | 13.0 | 13.0 |
| Verge | 11.0 | 10.5 | 11.0 |
| Penial sheath | 2.5 | 2.5 | 2.5 |
| Epiphallus | 18.5 | 18.0 | 20.0 |
| Epiphallic caecum | 1.0 | 0.5 | 1.0 |
| Vagina | 11.5 | 9.5 | 7.0 |
| Free oviduct | 3.0 | 4.0 | 3.0 |

Type locality: Picacho Mts., Pima Co., Arizona, in north facing rock piles on west side of canyon which runs southeasterly from Newman Peak, R 9 E, T 8 S, Sec. 26, SE $\frac{1}{4}$; elevation ca. 2500 ft. (J. Bequaert, M. L. Walton, W. N. Miller, and W. B. Miller, 27 Dec. 1965). Holotype ANSP. (308953). Paratypes in collections of ANSP. (308954), Dept. of Zoology, University of Arizona (1628), M. L. Walton (9245), and the author (4842).

The embryonic spiral threads vary in intensity, but are present at least to some degree on all specimens examined. Shell color varies from light brown to nearly white. One fresh specimen had no band at all and was completely white. There is a large variation in maximum diameter. The smallest paratype measured as follows: height 11.2 mm.; max. diam. 17.8 mm.; umbilicus 2.0 mm.; whorls $4\frac{3}{4}$. The largest paratype measured: height 12.7 mm.; max. diam. 22.1 mm.; umbilicus 2.6 mm.; whorls 5.

The shell of *S. simmonsii* has the general appearance of certain forms of *S. ambigua* from the Roskrige Mts., about 35 miles to the south, as well as some specimens of *S. sitiens* from the Ko Vaya hills (Cababi Mts.) about 55 miles to the southwest. It is readily distinguishable from these by the presence of spiral threads on the embryonic whorls. In the genitalia, it bears some resemblance to *S. ambigua* in the large, thick penis and verge. The shape of the verge differs, however, in that it slowly tapers for the last $\frac{2}{3}$ of its length to an abruptly truncate tip, while *ambigua* has a club-shaped verge with maximum diameter at the short-conic tip. Other differences are in the penial sheath, which is ca. $\frac{1}{6}$ the length of the penis in *simmonsii* and ca. $\frac{1}{3}$ in *ambigua*, the epiphallus, which is

ca. $1\frac{1}{2}$ times the length of the penis in *simmons*i and ca. $\frac{2}{3}$ to $\frac{3}{4}$ in *ambigua*, and the vagina, which is ca. $\frac{2}{3}$ to $\frac{3}{4}$ the length of the penis in *simmons*i, while it is about as long as the penis in *ambigua*.

Dead shells were collected by Mr. Norman M. Simmons of the Fish and Wildlife Service, while hunting in the Picacho Mts. and brought to the University of Arizona for identification. Subsequently, on 27 Dec. 1965, the author, accompanied by Dr. Joseph Bequaert, Mr. Munroe Walton, and the author's son, W. Nixon Miller, collected large numbers of live specimens and dead shells at the type locality. The holotype was selected from among the live adults, and all other specimens collected on this expedition have been designated paratypes.

It is probable that this snail is widespread in the Picacho Mts. Mr. Simmons stated that he had found shells in several other canyons in these mountains. This species is named for Mr. Simmons, whose interest in all branches of natural history was responsible for bringing this new species to the author's attention.

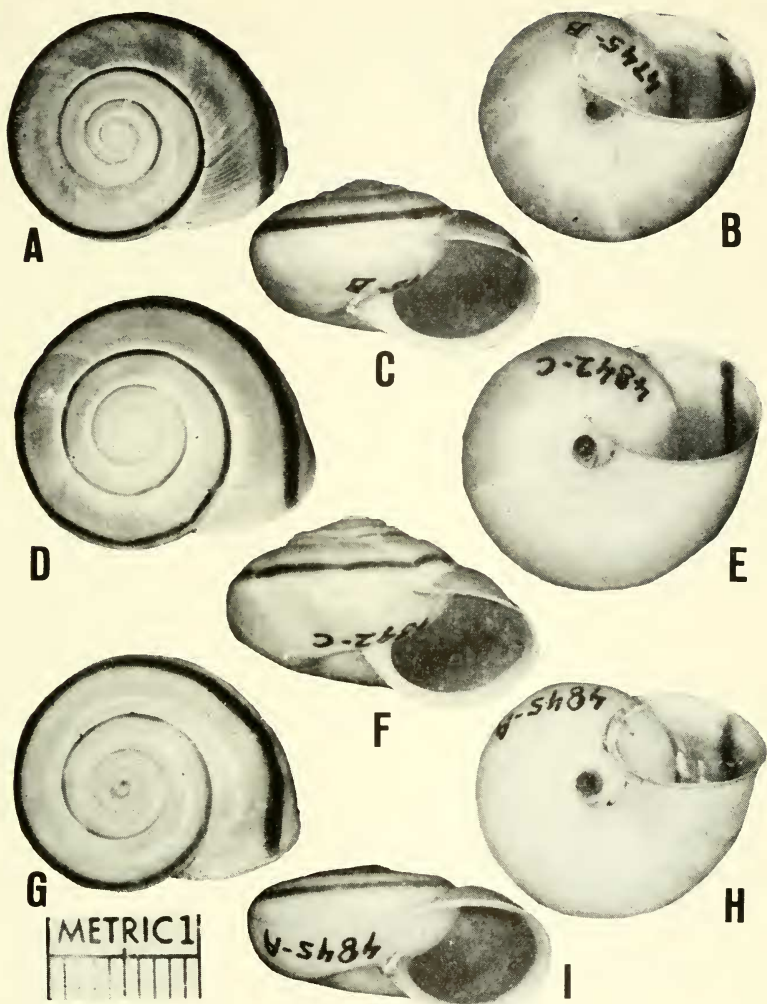
SONORELLA MEADI new species.

Plate 1, figs. G-I.

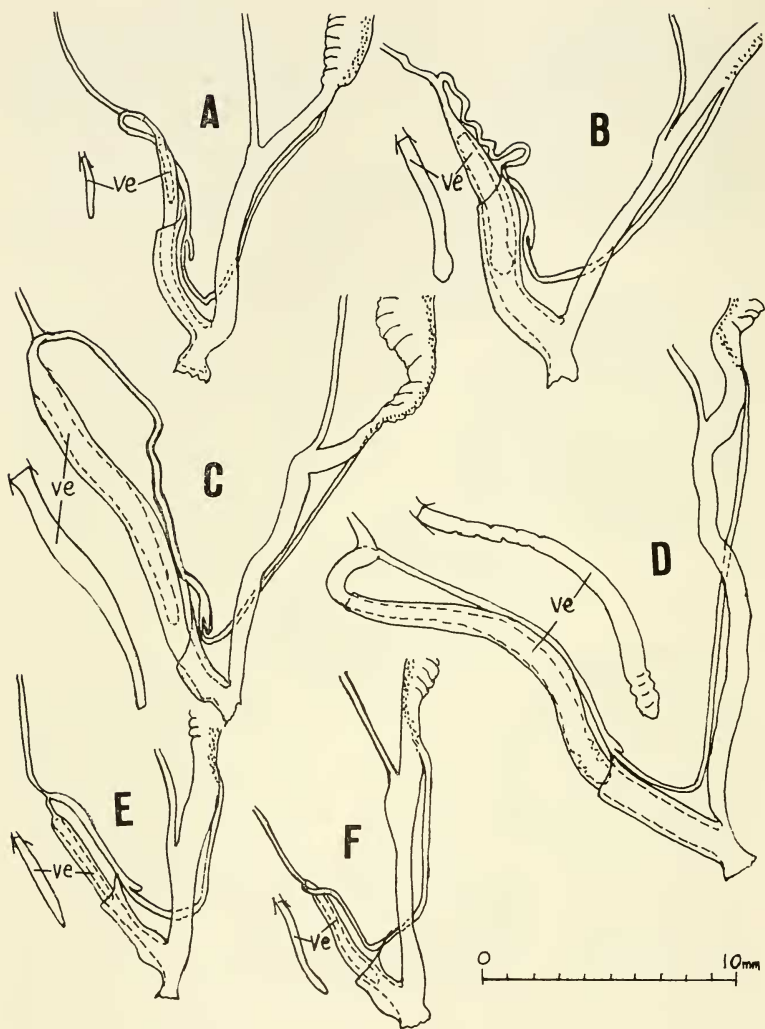
Description: Shell strongly depressed, heliciform, solid, glossy, light tan, fading to nearly white around the umbilicus, with a chestnut brown spiral band on the well rounded shoulder; widely umbilicate, the umbilicus contained 6 to 7 times in the diameter. Embryonic shell of about 1 and $\frac{1}{3}$ whorls, with sculpture of the *hachitana* type. Apex smooth, followed by an area of weak, irregular radial wrinkles; after the first half whorl, hyphen-like papillae are superimposed over the radial wrinkles. Over the last third of the embryonic shell, the hyphen-like papillae are elongated and run together to form forwardly descending spiral threads. Post-embryonic whorls with small papillae superimposed on weak radial wrinkles, the papillae numerous on the early whorls, gradually disappearing, and finally absent on the body whorl. Body whorl with faint spiral lines impressed on the shoulder between the chestnut-brown band and the suture. Body whorl descends shortly to the moderately expanded peristome. Aperture oblique, rounded-oval, slightly wider than high, with a moderately thick parietal callus.

Holotype measurements: Height 9.7 mm.; max. diam. 20.2 mm.; umbilicus 3.0 mm.; whorls $4\frac{1}{2}$.

Genitalia of holotype (Plate 2, fig. E): The penis contains a



Holotypes. A-C. *Sonorella baboquivariensis* *coxi* W. B. Miller D-F. *S. simonsi* W. B. Miller. G-I. *S. meadi* W. B. Miller.



Lower genitalia. A. *S. baboquivariensis cossi* W. B. Miller. B. *S. baboquivariensis* Pilsbry & Ferriss, Saucito ridge, Baboquivari Mts. C. *S. simmonsii* W. B. Miller. D. *S. ambigua* Pilsbry & Ferriss, Coyote Mts. E. *S. meadi* W. B. Miller. F. *S. eremita* Pilsbry & Ferriss, "San Xavier Hill" (type loc.). ve: verge. All drawings to same scale, drawn from stained whole mounts.